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Orientation to Computing-I

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UNIT - 3

Linux OS and its features

- Linux is one of the popular versions of the UNIX operating System.
- It is open source as its source code is freely available.
- It is free to use.
- Linux was designed considering UNIX compatibility.
- Its functionality list is quite similar to that of UNIX.

Linux OS and its features

Components of Linux System

Linux Operating System has primarily three components

- **Kernel** – Kernel is the core part of Linux. It is responsible for all major activities of this operating system. It consists of various modules and it interacts directly with the underlying hardware. Kernel provides the required abstraction to hide low level hardware details to system or application programs.
- **System Library** – System libraries are special functions or programs using which application programs or system utilities accesses Kernel's features. These libraries implement most of the functionalities of the operating system and do not require kernel module's code access rights.
- **System Utility** – System Utility programs are responsible to do specialized, individual level tasks.



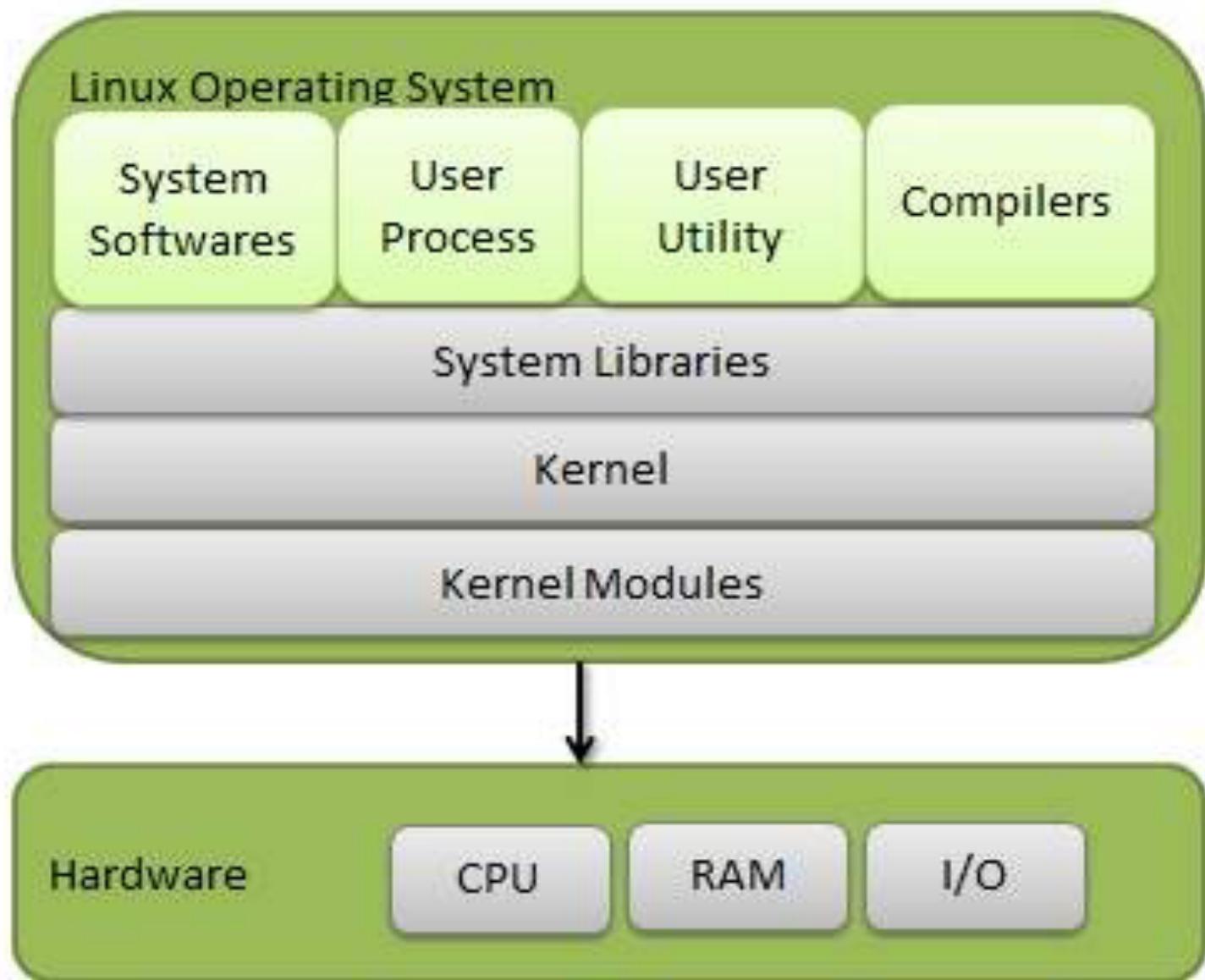
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• **Kernel Mode vs User Mode**

- Kernel component code executes in a special privileged mode called kernel mode with full access to all resources of the computer. This code represents a single process, executes in single address space and do not require any context switch and hence is very efficient and fast. Kernel runs each processes and provides system services to processes, provides protected access to hardware to processes.
- Support code which is not required to run in kernel mode is in System Library. User programs and other system programs works in User Mode which has no access to system hardware and kernel code. User programs/ utilities use System libraries to access Kernel functions to get system's low level tasks.





- **Basic Features**
- **Portable** – Portability means software can work on different types of hardware in same way. Linux kernel and application programs support their installation on any kind of hardware platform.
- **Open Source** – Linux source code is freely available and it is community based development project. Multiple teams work in collaboration to enhance the capability of Linux operating system and it is continuously evolving.
- **Multi-User** – Linux is a multiuser system means multiple users can access system resources like memory/ ram/ application programs at same time.
- **Multiprogramming** – Linux is a multiprogramming system means multiple applications can run at same time.
- **Hierarchical File System** – Linux provides a standard file structure in which system files/ user files are arranged.
- **Shell** – Linux provides a special interpreter program which can be used to execute commands of the operating system. It can be used to do various types of operations, call application programs. etc.
- **Security** – Linux provides user security using authentication features like password protection/ controlled access to specific files/ encryption of data.

Distribution versions

TOP 10 LINUX DISTRIBUTIONS

atlantic.net



Ubuntu



Rocky Linux



Red Hat Enterprise
Linux (RHEL)



Debian



Kali



SUSE Linux



Arch Linux



Raspbian



MX Linux



Fedora

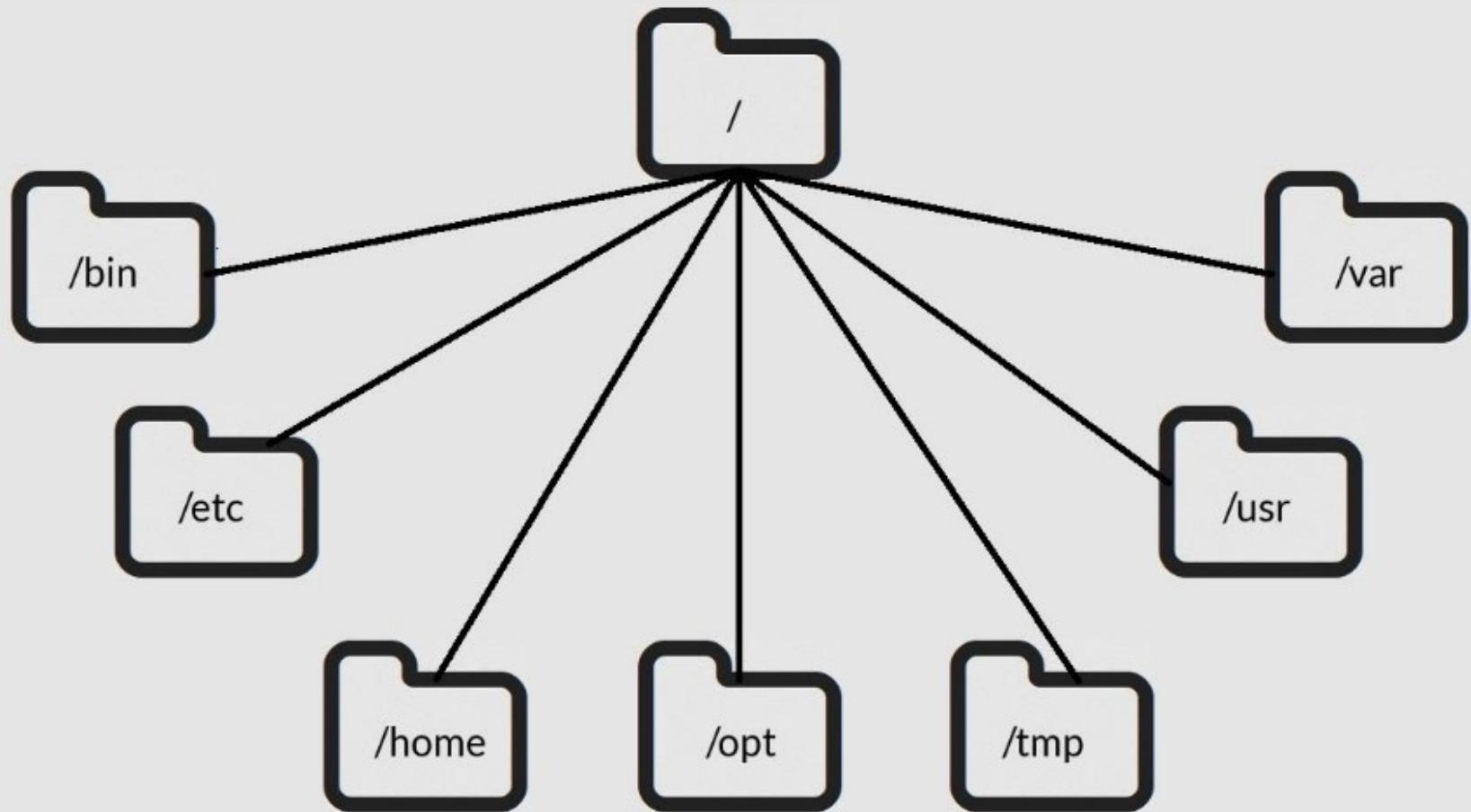


Installation

1. Insert a bootable Linux USB drive
2. Click the start menu
3. Then hold down the SHIFT key while clicking Restart
4. Then select Use a Device
5. Find your device in the list
6. Your computer will now boot Linux
7. Select Install Linux
8. Go through the installation process

Linux Directory Structure and File System Hierarchy

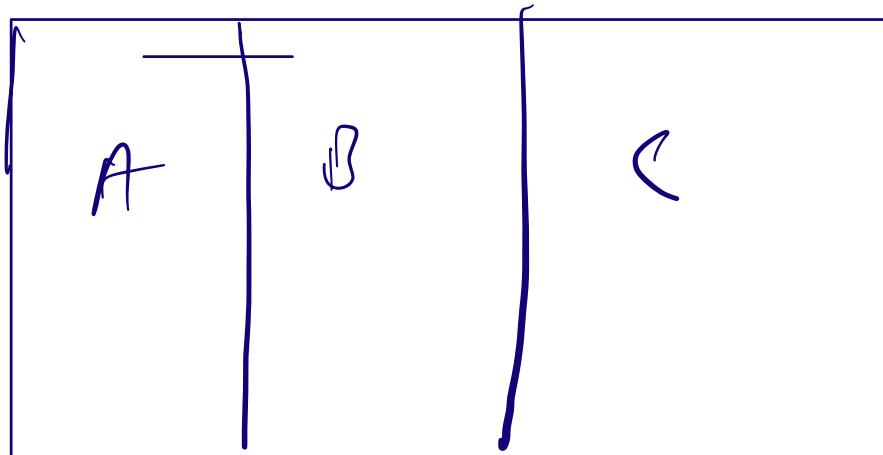
Dir	Description
/  . 	The directory called "root." It is the starting point for the file system hierarchy. Note that this is not related to the root, or superuser, account.
/bin 	Binaries and other executable programs.
/etc	System configuration files.
/home	Home directories.
/opt	Optional or third party software.
/tmp	Temporary space, typically cleared on reboot.
/usr	User related programs.
/var	Variable data, most notably log files.



How to partition a disk in Linux



- Creating and deleting partitions in Linux is a regular practice because storage devices (such as hard drives and USB drives) must be structured in some way before they can be used.
- In most cases, large storage devices are divided into separate sections called partitions. Partitioning also allows you to divide your hard drive into isolated sections, where each section behaves as its own hard drive.





How to partition a disk in Linux

The following explains the process of partitioning a storage device with the parted command.

- **List the partitions:** Use `parted -l` to identify the storage device you want to partition.

- Typically, the first hard disk (`/dev/sda` or `/dev/vda`) will contain the operating system, so look for another disk to find the one you want (e.g., `/dev/sdb`, `/dev/sdc`, `/dev/vdb`, `/dev/vdc`, etc.).



↓ ar parted with

- **2. Open the storage device:** Use parted to begin working with the selected storage device. It is important to indicate the specific device you want to use. If you just type parted with no device name, it will randomly select a storage device to modify.
parted with dev/dvc

- **3. Set the partition table:** Set the partition table type to GPT, then type "Yes" to accept it. The mklabel and mktab commands are used for the same purpose↑(making a partition table on a storage device). The supported partition tables are: aix, amiga, bsd, dvh, gpt, mac, ms-dos, pc98, sun, and loop. Remember mklabel will not make a partition, rather it will make a partition table.

mk label

- ✓ **4. Review the partition table:** Show information about the storage device.

- **5. Get help:** To find out how to make a new partition, type:
(parted) help mkpart.

- **6. Make a partition:** To make a new partition (in this example, 1,396MB on partition 0), type the following:
(parted) mkpart primary 0 1396MB

(parted) mkpart primary 0 1396 MB



Comparison of Windows and Linux OS

S.NO	Linux	Windows
1.	Linux is a open source operating system.	While windows are the not the open source operating system.
2.	Linux is free of cost.	While it is costly.
3.	It's file name case-sensitive.	While it's file name is case-insensitive.
4.	In Linux, monolithic kernel is used.	While in this, micro kernel is used.
5.	Linux is more efficient in comparison of windows.	While windows are less efficient.
6.	There is forward slash is used for Separating the directories.	While there is back slash is used for Separating the directories.
7.	Linux provides more security than windows.	While it provides less security than Linux.
8.	Linux is widely used in hacking purpose based systems.	While windows does not provide much efficiency in hacking.
9.	There are 3 types of user account – (1) Regular , (2) Root , (3) Service account 	There are 4 types of user account – (1) Administrator , (2) Standard , (3) Child , (4) Guest
10.	Root user is the super user and has all administrative privileges.	Administrator user has all administrative privileges of computers.
11.	Linux file naming convention is case sensitive. Thus, sample and SAMPLE are 2 different files in Linux/Unix operating system. 	In Windows, you cannot have 2 files with the same name in the same folder.



VM1 VM2

Virtual Machines

- A Virtual Machine (VM) is a compute resource that uses software instead of a physical computer to run programs and deploy apps. One or more virtual “guest” machines run on a physical “host” machine. Each virtual machine runs its own operating system and functions separately from the other VMs, even when they are all running on the same host. This means that, for example, a virtual MacOS virtual machine can run on a physical PC.
- Virtual machine technology is used for many use cases across on-premises and cloud environments. More recently, public cloud services are using virtual machines to provide virtual application resources to multiple users at once, for even more cost efficient and flexible compute.

- **What are virtual machines used for?**
- Virtual machines (VMs) allow a business to run an operating system that behaves like a completely separate computer in an app window on a desktop.
- VMs may be deployed to accommodate different levels of processing power needs, to run software that requires a different operating system, or to test applications in a safe, sandboxed environment.
- Virtual machines have historically been used for server virtualization, which enables IT teams to consolidate their computing resources and improve efficiency.

↳

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- **What are virtual machines used for?**

Additionally, virtual machines can perform specific tasks considered too risky to carry out in a host environment, such as accessing virus-infected data or testing operating systems. Since the virtual machine is separated from the rest of the system, the software inside the virtual machine cannot tamper with the host computer.

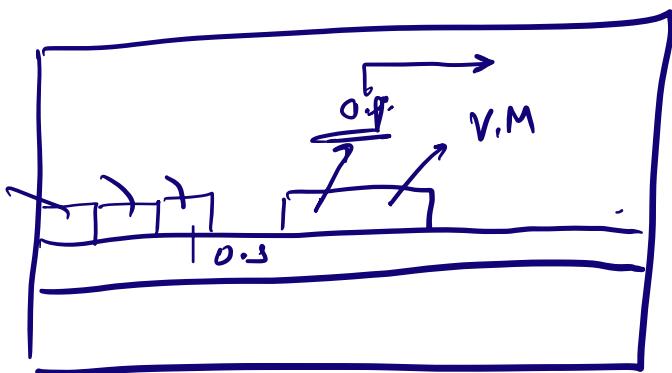
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- **How do virtual machines work?**

- The virtual machine runs as a process in an application window, similar to any other application, on the operating system of the physical machine. Key files that make up a virtual machine include a log file, NVRAM setting file, virtual disk file and configuration file.

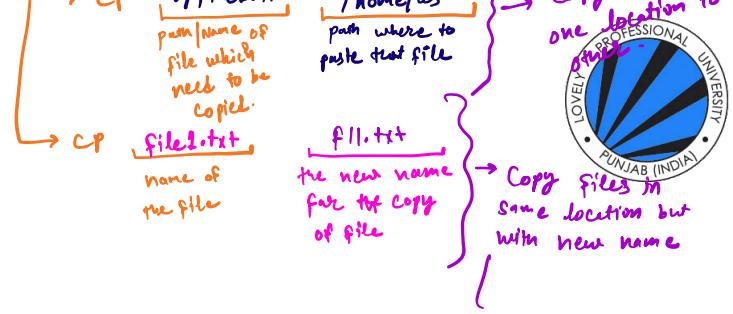


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Other Shell Commands:

- ls
- cat
- man
- cd
- touch
- cp
- mv

1. whoami → name of your login user
2. pwd → print current working directory.
3. man → manual of all other command.
↳ man ls → manual of ls command will open.
Press q - to exist from manual.
4. ls → list the directory content
 - ↳ ls → list the content of pwd.
 - ↳ ls /home → list the content of mentioned path.
 - ls -l → long listing.
5. cd → used to change directory.
 - ↳ cd /home → go the path(home)
 - cd .. → go to the previous directory.
 - cd → go to home user
 - ↳ cd / → used to go to the root directory.
6. mkdir → used to create directory
 - ↳ mkdir k2ape → With ^{name} directory will be created.
 - ↳ mkdir f1 f2 f3 → to create multiple directory
multiple names separated by space
7. rmdir → remove only empty directory.
 - ↳ rmdir k2ape → Remove empty dir.
 - ↳ rmrdir space separated name of empty dir. → Remove multiple dir.
8. touch → create any empty file or new file.
 - ↳ touch file1.txt → file1.txt will be created.
9. rm → remove files and directory.
 - rm file1.txt → Removing file1.txt
 - rm -r k2ape → Remove non-empty directory.
 - ↳ recursive R
10. cat → display the data, Entering the data, Appending the data, Concatenating the data.
 - Cat file1.txt → Display the data of file1.txt
 - Cat > file1.txt → Enter the data into file1.txt.
 - Cat >> file1.txt → Append the data in the file(already having some data)
 - Press: Ctrl + D → to save and exit from file.
 - Ctrl + D → to save and exit from file.
11. mv → used to move or rename a file/dir
 - ↳ Current → mv ./file1.txt → location of a file you want to move
 - ↳ Previous → ... → location where you want to move that file/dir.
 - mv file1.txt new.txt → Rename file1.txt into new.txt.
 - ↳ used to move to file/dir.
12. cp → to copy the file.
 - cp file1.txt file2.txt → Copy file from to



ls command

- The ls command is used to list files or directories in Linux and other Unix-based operating systems.
- Use of ls command as below:

List files in the current working directory

Type the `ls` command to list the contents of the current working directory:

A screenshot of a terminal window on a Mac OS X desktop. The window title is "Terminal". The command `ls` is entered at the prompt. The output shows the contents of the current directory, which includes standard system folders like Applications, Library, and Public, along with a localized file and a color profile. The terminal has a dark theme with light-colored text.

```
bolajaiyodeji@Bolajis-MacBook: ~
→ ~ ls
Applications      Library          Public
Desktop           Movies           Virtual Machines.localized
Documents          Music            new-moon.terminalcolors
Downloads         Pictures
→ ~
```



cat command

- Outputs the contents of a text file.
- You can use it to read brief files or to concatenate files together.
- To append file1 onto the end of file2, enter:
 - `cat file1 >> file2`
- To view the contents of a file named myfile, enter:
 - `cat myfile`



man command

- The man command is **a built-in manual for using Linux commands**.
- Displays the user manual of any command that we can run on the terminal. It provides a detailed view of the command which includes NAME, SYNOPSIS, DESCRIPTION, OPTIONS, EXIT STATUS, RETURN VALUES, ERRORS, FILES, VERSIONS, EXAMPLES, AUTHORS.
- Basic Symbol

```
man [option] [section number] [command name]
```

- **option** – the search result output.
- **section number** – the section in which to look for the man page.
- **command name** – the name of the command which man page you want to see.



cd command

- It changes your current directory location.
- By default, your Unix login session begins in your home directory.
- To switch to a subdirectory (of the current directory) named myfiles, enter:
- cd myfiles
- To switch to a directory named /home/dvader/empire_docs, enter:
- cd /home/dvader/empire_docs

Touch

The **touch** command's primary function is to modify a timestamp.

Option	Description
-a	Changes the access time.
-c --no-create	Avoids creating a new file.
-d=<string> --date=<string>	Changes a timestamp using a date string.
-f	No effect. In older BSD's the option forces changes.
-h --no-dereference	Changes a symbolic link's timestamp.
-m	Changes the modification time.
-r=<file> --reference=<file>	Changes a timestamp to the referenced file's timestamp.
-t <stamp>	Modifies a timestamp, where the stamp is the date/time format.
--help	Opens the help menu.
-v --version	Prints the program version.



cp

- This command copies a file, preserving the original and creating an identical copy.
 - `cp -i oldfile newfile`

mv

mv stands for move.

mv is used to move one or more files or directories from one place to another in a file system like UNIX.

Use it as:

`mv [Option] source destination`

chmod

- This command changes the permission information associated with a file.



Mkdir

- The mkdir command is used to create (or make) a directory.
- Example:
- # mkdir LPUCSE

rmdir

- The rmdir directory is used to remove directories, but only those that are empty (i.e., contain no files or subdirectories). In order to delete a directory with actual contents, you must use the **rm -R** command.
- Example
- To remove an empty directory:
- # rmdir /mike



Rm

Use the rm command to remove files you no longer need.

Example

Removing one file at a time

```
$ rm CSEA.txt
```

Pwd

Simply type pwd into your terminal, and the command will output the absolute path of your print working directory.

The pwd command writes to standard output the full path name of your current directory (from the root directory). All directories are separated by a / (slash). The root directory is represented by the first /, and the last directory named is your current directory.

The ps command, short for Process Status, is a command line utility that is used to display or view information related to the processes running in a Linux system.



ps

The ps command, short for **Process Status**, is a command line utility that is used to display or view information related to the processes running in a Linux system.

kill

kill command in Linux (located in /bin/kill), is a built-in command which is used to **terminate processes manually**.



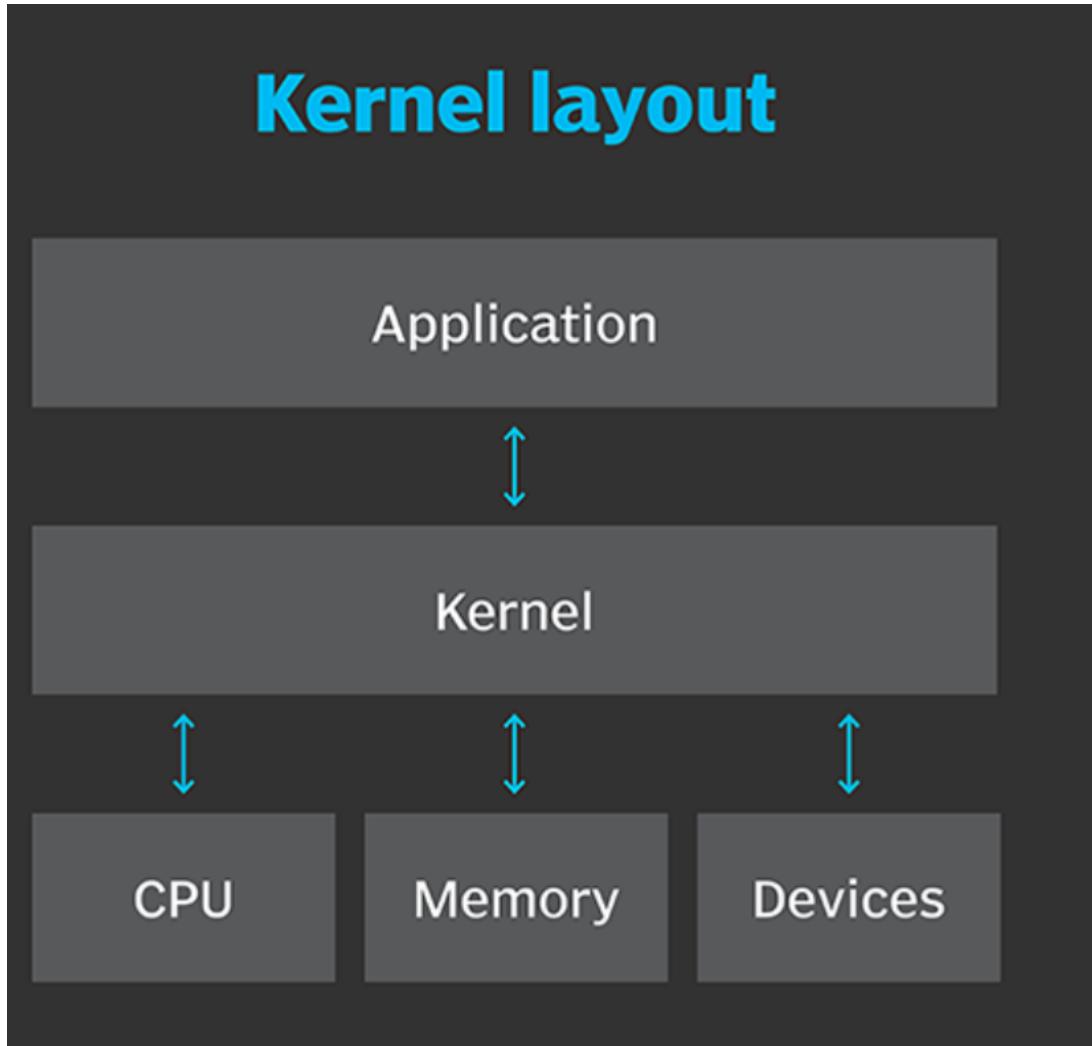
- Activity
- Execute various commands on Linux Operating System



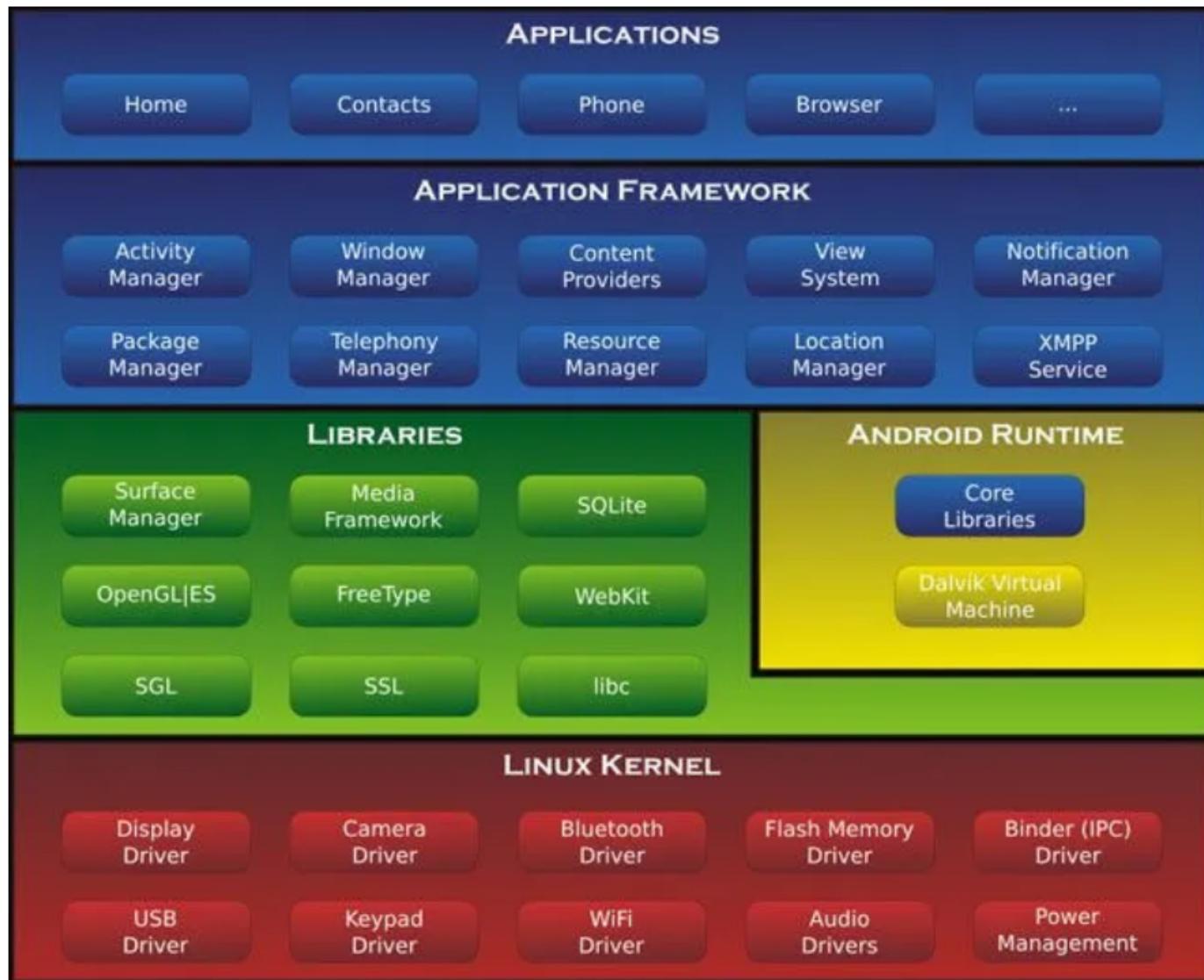
Kernel and types of kernels

- A Kernel is an intermediary between applications and hardware.
- **Functions of a Kernel**
 - A Kernel in an operating system performs the following functions:
- **Device Management:** Processes require various peripheral devices such as a mouse and keyboard connected to the computer to perform various tasks. The Kernel manages the allocation of the peripheral devices.
- **Resource Management:** Kernel shares the resources between different processes while ensuring that every process has uniform access to the resources.
- **Memory Management:** Every process requires some memory to execute. The Kernel allows the processes to access the memory safely.
- **Access Computer Resource:** A kernel can access different computer resources such as RAM, CPU, I/O devices, and other resources. The Kernel decides which memory each process will use, and the action is taken if memory is unavailable.

More about Linux Kernel



More about Linux Kernel

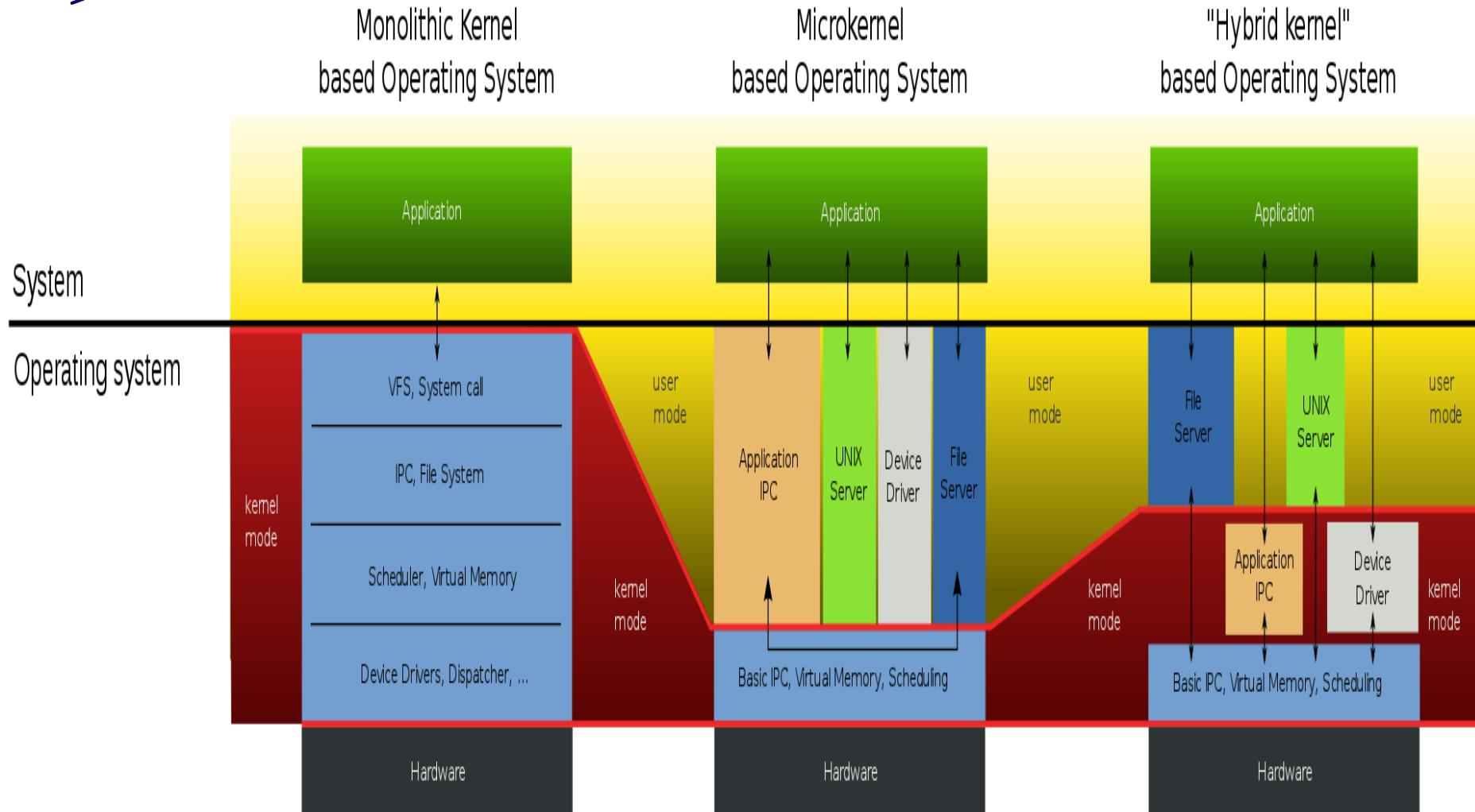


Basic types of kernels

- 3 basic types of kernels as below:
 - Monolithic ✓
 - Microkernel
 - Hybrid ↗
- A monolithic kernel is a type of kernel in which the complete OS runs in the kernel space.
- A microkernel is a kernel type that implements an operating system by providing methods, including low-level address space management, IPC, and thread management.
- A hybrid kernel is an operating system kernel architecture that attempts to combine aspects and benefits of microkernel and monolithic kernel architectures used in computer operating systems.

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Basic types of kernels



1. whoami → Print your current user.

2. pwd → Print current working directory.

3. ls → listing the content of pwd

→ ls /home _{path} → list the content of mentioned path.

→ ls -l → long listing.

4. cd → change directory.

→ cd /home/as _{path} → change directory to your as user/mentioned path.

→ cd .. → going to previous directory

→ cd / → going to root directory.

→ cd → going to home user directly.

5. touch → used to create empty files.

→ touch file1.txt _{name of the file} → file1.txt will be created.

6. mkdir → used to create directory.

→ mkdir k24PD _{Name of the dire.} → Create new directory with name k24PD.

→ mkdir f1 f2 f3 file _{multiple names separated by space} → Create multiple directories with one command.

→ mkdir {f1,f2,f3,f4} →

7. rmdir → Remove only empty directory.

→ rmdir k24PD _{name of the directory} → This will remove k24PD directory if it is empty.

8. rm → Remove file/directories

→ rm file1.txt _{name of file} → it will remove file1.txt.

→ rm -r k24PD _{name of dir} → Remove k24PD and its data

recursive
R
Non-
empty
directory

9. mv → move or rename a file/dirs.

• / → Current → mv • ./file1.txt
• .. → Parent or Previous → path of the file which you want to move
→ mv .. /
 file1.txt path of dir where you want to get it moved.
 f11.txt move file1.txt from current location to parent location.
 new name Renaming a file from current working directory.

10. cat → display the data, Enter the data, Append the data, Concatinate the data in the file.

→ cat file1.txt → display the content of file1.txt
 name of the file

→ cat > file1.txt → enter the data into the file.
 Redirection operator Name of file

Press Ctrl + D → to save and exit from the file.

→ cat >> file1.txt → Append the data in the file1.txt which already have some data.

press Ctrl + D → to save and exit.

11. cp → Copy files/directories.

→ cp ./file1.txt
 location of the file which you want to copy
→ cp /home/as
 location where to paste it.

make a copy of file1.txt in as directory.
Create the copy of file in different directory.

→ cp file1.txt
 Name of file you want to copy in same
 f11.txt Create the copy of file in same directory.

12. man → open the manual of other command.

→ man ls → manual of ls will open.
name of command
press q to exit from the manual.

13. head → Print top 10 lines from the file
by default 10 line

→ head file1.txt → print top 10 lines of file1.txt
name of the file

→ head -n 2 file1.txt → print top 2 lines from file1.txt.
number number of line or
head -2 file1.txt

14. tail → used to print bottom 10 lines of file

→ tail file1.txt → print last 10 lines of the file1.txt.
Name of the file

→ tail -n 3 file1.txt → print last 3 lines of file1.txt
or
tail -3 file1.txt

15. chmod → used to change the permissions of file

+ → to grant the permission

u → owner user
g → groups

R → 4
w → 2

